SUPPORT FOR THE AMENDMENT

This Amendment amends Claim 3. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claims 3 is found in the specification at least at page 10, lines 1-5. No new matter would be introduced by entry of these amendments.

Upon entry of these amendments, Claims 1-9 and 11-13 will be pending in this application. Claims 1, 2, 3 and 6 are independent. Claims 1-2, 6, 9 and 11-12 are withdrawn from consideration pursuant to a Restriction Requirement.

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

The present invention relates to the manufacture of hot-rolled and cold-rolled austenitic iron/carbon/manganese steel sheets exhibiting a particularly advantageous combination of mechanical strength and elongation at fraction, excellent formability and a high tensile strength in the presence of defects or stress concentrations. Specification at page 1, lines 7-14.

Claims 3-5, 7-8 and 13 are rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,358,338 ("Guelton") in view of WO 93/13233 ("Kim") and further in view of "Design for Deformation Processes", ASM Handbooks Online, Vol. 20 ("Ferguson").

Guelton discloses a process for producing strip made of an iron-carbon-manganese alloy (Guelton at abstract). Guelton proposes a fabrication method of ferrous alloys more rapid and less expensive than previous fabrication methods, with product at least as good in quality. Guelton at column 1, lines 47-52. This is obtained by direct casting and Guelton

discloses explicitly that the invention relies on the use of a process for direct casing of thin strip. Guelton at column 2, lines 4-6.

In contrast, the aim of the present invention is to propose a fabrication method of hot- or cold rolled Fe-C-Mn sheets, displaying higher characteristics of strength and elongation while limiting the addition of costly alloying elements. The sheets must have good aptitude to deep drawing, and a high toughness in static or dynamic conditions. Specification at page 2, line 34 to page 3, line 14.

Thus, the aims of Guelton and the present invention are clearly different.

Regarding claim 3:

The present inventors have discovered that certain microstructural features are essential for achieving the required properties and that the correlation between these properties and features are not linear or "smooth" but very steep. In other words, an unexpected threshold behavior was observed:

- For example: the specification at Figure 5 indicates that the product P (strength x elongation at break) drastically decreased when the surface fraction of precipitated carbides exceeded above 1.5%.
- Moreover, as shown in the specification at Figure 3, the present inventors have discovered that this surface fraction of precipitated carbides depends very abruptly on the coiling temperature.
- In the same way, the specification at Figures 11 and 12 indicates that the bending and the forming capabilities are critically dependent on the austenite grain size.

It is thus clear that the process according to the present invention corresponds to a very particular domain where all the conditions are fulfilled in order to manufacture a steel sheet with a microstructure satisfying to these critical conditions.

By contrast, Guelton teaches that the manufacturing conditions do not matter:

> ... [T]here is no **significant metallurgical advantage** in hot rolling high manganese austenitic steels. Guelton at column 2, lines 42-43 (emphasis added).

The hot rolling may be simply applied to close up eventual porosity and to improve its surface finish (Guelton at column 2, lines 49-50; column 4, lines 2-6; column 3, line 63; column 4, line 57).

The Office Action at page 6, lines 7-8, states that "Guelton et al. is silent as to the temperature of the slab during hot-rolling".

However, Guelton is not silent since it states that hot rolling has no importance and could be performed at any temperature. According to Guelton :

> The temperature at which this hot rolling is carried out is **not of great importance** from the metallurgical standpoint since, as was mentioned, the steel has an austenitic structure at any temperature and therefore does not undergo a phase transformation which could influence the qualitative result of hot rolling. Guelton at column 4, lines 13-18 (emphasis added).

This teaching is very different from the present invention which discloses that the end-of-rolling has to be performed higher than 890°C, otherwise hot deformability and cracking problems may occur. Specification at 10, lines 32-34.

Regarding the length of time between the hot-rolling and the cooling step, Guelton is completely silent on this point. It is underlined that this feature derives from the finding of the present inventors that the capability for bending or the toughness properties was very dependant on the recrystallized fraction. Specification at page 11, lines 17-27; page 19, lines 15-19; page 20, lines 4-7, lines 22-25; Figure 11). By contrast, Ferguson (page 4, first paragraph) discloses only general indications (e.g., "a hold time at elevated temperature causes static recovery and recrystallization to result in a fine grain size").

But certainly, the person skilled in the art would have not combined the opposite teachings of Guelton (hot rolling conditions have no importance on FeMn austenitic steel) and the very general teaching of Ferguson ("a hold time at elevated temperature causes static recovery and recrystallization to result in a fine grain size").

According to Guelton, coiling is optional.

> [T]he strip may possibly be coiled, here again at a temperature which is of **hardly any importance** other than from a practical standpoint since no appreciable metallurgical transformation, other than grain growth, is liable to occur during the period during which the coiled strip is cooled at a low rate. Guelton at column 4, lines. 19-24 (emphasis added).

Here again, the teaching of Guelton is completely opposite to the present invention since the specification at Figure 1 discloses that the coiling temperature has a very direct and marked influence on the precipitation of carbides, which in turn has a critical influence on the product P (strength x elongation at break). Specification at Figure 5; page 12, lines 1-13; page 20, lines 2-3.

Moreover, Guelton teaches that the coiling "may be the occasion to complete the precipitation of carbides, nitrides and carbonitrides". Guelton at column 4, lines 27-30. This is again in complete opposition with the process of Claim 3 whose aim is precisely to limit as much as possible the precipitation of carbides and nitrides. Specification at page 12, lines 6-9; page 8, lines 28-35.

Furthermore, Claim 3 of the present invention refers to a fabrication process of a hot rolled sheet with very high mechanical properties, whereas Guelton discloses the fabrication of a cold rolled and annealed sheet (claim 1). Hot rolling is not necessary in Guelton and could be completely avoided if the strip is satisfactory in terms of porosity and surface finish.. Guelton at column 3, lines 61-63. Guelton does not disclose a fabrication process of a hot-rolled sheet with high characteristics since the results of Table 1 in column 5 refer only

to cold rolled sheet. Thus, the absence of any results on hot rolled sheets might even be interpreted by the man skilled in the art as an indication that it is not possible to obtain high mechanical properties on the hot rolled sheet.

Kim discloses compositions based on a combination of Mn and Al which is different from the present invention. See, e.g., Kim at Figure 1. Kim teaches at page 8, lines 18-21, that "if its [Al] content is less than 0, 1%, ϵ martensites are formed to deteriorate the elongation ... with the result that cold workability and press formability is deteriorated". In contrast, the process of the present invention is applied to steels with less than 0.050% Al because of unwanted nitride precipitation. Specification at page 8, lines 24-36.

Hot rolling in Kim refers in fact to a usual process, as is indicated in Kim at page 11, lines 8-10 ("the hot rolling for the steel of the present invention is carried out in the normal manner..." (emphasis added)). This is completely different from the process of claim 3 of the present invention wherein all the steps have been selected on the basis of unexpected correlation between the process and the properties/microstructure as described above.

Kim does not disclose or suggest a process according to claim 3 wherein a specific delay between the end of rolling and the subsequent cooling has to be observed. Similarly, Kim does not disclose or suggest a process wherein the sheet is coiled at a temperature lower than 580°C in order to obtain no significant precipitation . Kim at page 11, line 31. Example 1, page 13; Example 2, page 17; and Example 3, page 18 of Kim do not include such steps. Thus, Kim certainly does not suggest to the man skilled in the art that these steps are essential for obtaining the properties aimed by the invention.

The Office Action at page 6 lines 2-3 asserts that Guelton "warns that the temperature [during coiling] should not be so high to promote grain growth (col. 4, lines 22-27)".

On the contrary, Guelton discloses:

> [T]he strip may possibly be coiled, here again at a temperature which is of **hardly any importance** other than from a practical standpoint since no appreciable metallurgical transformation, other than grain growth, is liable to occur during the period during which the coiled strip is cooled at a low rate. In any case, the **grain growth** will be **only of limited extent**, the effect of which will be easy to eliminate by the cold -rolling and annealing operations which follow. Guelton at column 4, lines. 19-27 (emphasis added).

The cited prior art fails to suggest the independent claim 3 limitation that "said sheet is coiled at a temperature below 580°C". Furthermore, there is no reasonable expectation that Guelton, alone or in view of Kim and Ferguson, would have led the skilled artisan to the independent claim 3 limitation that "said sheet is coiled at a temperature below 580°C".

Thus, rejection under 35 U.S.C. 103(a) over Guelton in view of Kim and further in view of Ferguson should be withdrawn.

Claims 5 and 7 are further patentably distinguishable over the cited prior art.

Regarding claim 5:

Referring to claim 3, the process in claim 5 includes a further step wherein the hot rolled sheet is subjected to a cold deformation with an equivalent deformation ratio of 30% or less.

Guelton discloses the possibility of an additional skin-pass, but this additional step is performed on the cold rolled and annealed sheet (Guelton at column 5, lines 35-39) and not on the hot rolled sheet. This possibility of additional cold deformation is present in the invention because hot rolled sheets have a very large reserve of plasticity (specification at page 14, lines 14-15) which makes it possible to increase the strength with equivalent strain up to 30%. As Guelton does not disclose any properties in the hot-rolled state, the man skilled in the art would not be incited to implement additional cold deformation such as skin-pass.

Regarding claim 7:

Claim 7 is relative to a process wherein a hot rolled sheet according to the invention is fabricated then cold rolled at temperature between 600 and 900°C for a time between 10 and 500 seconds, followed by a cooling step with a cooling rate greater than 0.5°C/s, the austenitic grain size before the final cold rolling and annealing step being less than 18 microns.

Even if Guelton teaches a process including a cold rolling, annealing and cooling step, it does not contain the characteristic feature that the austenitic grain size must be less than 18 microns before the last cold rolling and annealing step. This makes it possible to achieve an grain size ranging from 0.5 to 15 microns on the final product. Specification at page 13, lines 24-28.

Kim only teaches that, as for the hot rolling step, "the cold rolling is also carried out in the normal manner". Kim at page 11, lines 21-22.

Thus, claim 7 can not be derived from any combination of Guelton, Kim and Ferguson.

As a result, Claims 5 and 7 are further patentably distinguishable over the cited prior art.

Claims 3-5 and 13 are rejected under 35 U.S.C. §112, second paragraph. To obviate the rejection, Claim 3 is amended to recite "a semifinished product is smelted and cast".

In view of the foregoing amendments and remarks, Applicant respectfully submits that the application is in condition for allowance. Applicant respectfully requests favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Corwin Paul Umbach

Corwin P. Umbach, Ph.D.
Registration No. 40,211

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/07)